

- Hypnum Haldanianum* Grev. (no. 322).
Hypnum ochraceum Turn. (no. 322.11).
Leskea polycarpa Ehrh. (no. 265).
 **Leskea nervosa* (Schwaegr.) Myrin.
Mnium sylvaticum Lindb. (no. 160).
Plagiothecium denticulatum (L.) Br. & Sch. (no. 314).
Plagiothecium turfaceum Lindb.
Pogonatum alpinum (L.) Roehl. (no. 180).
Raphidostegium recurvans (Mx.) J. & S. (no. 307).
Rhynchostegium rusciforme (Neck.) Br. & Sch. (no. 305).
Sphagnum acutifolium (Ehrh.) Russ. & Warnst. (no. 4).
 **Sphagnum acutifolium purpureum* Warnst.
Sphagnum acutifolium rubrum (Brid.) Warnst.
Thuidium delicatulum (L.) Mitt. (no. 274).
Thuidium recognitum (Hedw.) Lindb.
 **Thuidium scitum aestivale* Aust.
Webera sessilis (Schmid.) Lindb. (no. 172).

SCALE-MOSSES.

- Geocalyx graveolens* (Schrader.) Nees (no. 17).
Plagiochila asplenoides (L.) Dum. (no. 20).
Scapania nemorosa (L.) Dum. (no. 15).
Trichocolea tomentella (Ehrh.) Dum. (no. 7).

WASHINGTON, D.C.

THE RELATION OF CERTAIN PLANTS TO ATMOSPHERIC MOISTURE.

ROBERT G. LEAVITT.

(Concluded.)

ORCHIDS (continued). A very few figures will convey a more precise idea of the behavior of cut roots in a humidity of from .90 to .95, mostly nearer the higher figure.

Species.	Wt. at start. Gms.	Time elapsed.	Conditions.	Loss. Gms.	Temperature.
<i>Dendrobium nobile.</i>	.535	24 hrs.	In lab.	.095	70° ±
	.440	46 hrs.	.95 ± hum.	.040	66°-69°
Dry weight	.340				
<i>Burlingtonia decora.</i>	.310	4 days	"	.040	"
<i>Oncidium varicosum.</i>	1.10	2 days	"	.08	"
Dry weight	.21				

The dry weight was determined after heating for a while in a sterilizing oven at above 100° C.

The *Dendrobium* root at the beginning of the test contained water to the amount of .36+ of the root's total weight. In 24 hours in a damp laboratory it lost .48+ of the above water. At once thereafter, in 46 hours in the damp-box it lost .40 of the water remaining. At the end of the test the water left in the root formed .15 of the total weight. The *Oncidium* root had been somewhat dried. Its percentage of water was then .80+, but it lost water much less rapidly than the *Dendrobium*, the water still retained after 48 hours in the box being .79 of the whole weight. In a root of *Brassia Wrayae* the proportion of water had fallen from .78 to .73 of the whole weight after 46 hours in the box.

These figures indicate a very good reason why the roots used have no observable condensing power. Even when dry to the touch and apparently in condition to absorb vapor they still hold a considerable percentage of water. Their state is quite different from that of freshly prepared charcoal, for instance, the activity of which in absorbing gases is so remarkable. The walls of the velamen of the orchid root are already saturated with moisture drawn from the living cells; and in the cases under observation draw away and give off so much water that the living cells perish.

Whole plants were used as follows, the first method being that proposed by Dr. Goodale.

A young shoot of *Dendrobium nobile*, bearing two leaves less than two inches long, and provided with aërial roots aggregating 28 inches in length, was cut from the parent plant, the cut sealed, and the young plant left to dry for several days. Medium weight sheet rubber was tied over the mouth of an inverted beaker. Through a puncture the transpiring parts of the young *Dendrobium* were introduced into the space thus formed, and the receptacle was made as nearly air-tight as possible. While the roots were thus left free, and the shoot was under fairly normal conditions, no moisture could escape except from the roots. If these condensed vapor the plant and whole apparatus would gain weight. Calcium chloride in a test tube had been included along with the shoot in order to take up moisture evaporating from the leaves.

After weighing, this apparatus was set so that the roots of the plant hung in a box of the kind before described, the beaker and contained shoot being at the same time exposed to the light. A control appa-

tus, lacking a plant, was also used and weighed in the same way as the first. This suffered slight changes of weight, by evaporation from the rubber, but these were always trifling compared with the losses of the other contrivance.

The experiment was repeated with another young *Dendrobium* plant having three small leaves and 96 inches of roots. No calcium chloride was used.

The tests lasted four, five, and six days respectively. Every successive weighing showed a somewhat diminished weight. In three days, through the 28 inches of slender and dry roots of the first plant about .07 gram was lost. The second plant lost about the same amount in like condition in the same time. In both cases the leaves were transpiring; and the test was carried on until the second plant was plainly suffering for want of water, although the air about the roots was very nearly (.95) saturated with water-vapor.

These two *Dendrobiums*, with still a third, have been hung unprotected in a greenhouse where the atmosphere is well charged with moisture, and from time to time their weights have been determined. No. 1, though not watered for seven weeks, is green and healthy. The stem is somewhat shrivelled. It has lost .57 gram weight in the last 20 days, a little more than one-eleventh of the present gross weight. The others also slowly decline in weight.

It remains to be proved conclusively that the roots of any orchids possess a special condensing power. The fitness of the velamen for such a function may well be classed with the "evident" adaptations.

TILLANDSIA. A piece of *T. usneoides*, which had hung in the greenhouse, was tested in the damp-box in the same manner as the orchid roots. Tips here and there finally dried up and died, and the whole lost weight continuously for a long time. This plant probably has no power of absorbing water in the gas form.

MOSSES. The reservoir-cells of *Sphagnum* and *Leucobryum* in some respects resemble the tracheid-like elements which give the covering of the orchid root its peculiar spongy character. Kerner attributes to them the same function, viz., the appropriation of water-vapor from the atmosphere at those seasons of the year when the supply from the ground is cut short by drought.

Leucobryum, *sp.* December 19, the moss was gathered in a dryish condition. It was left in the laboratory for two days, when it seemed very dry to the touch. It was then weighed and put into the box.

December 21, 9.30 A. M., it weighed .337 gram.

December. 22, 4.45 P. M., it weighed .230 gram.

December 28, the weight had not apparently changed.

Dry weight, .195. Humidity during test, about .93.

Thus in 31 hours the percentage of water fell from .42 to .15, when equilibrium was reached.

Sphagnum, *sp.* The material was picked from a recently collected but pretty dry heap of the moss, and the dead portions removed, leaving tips perhaps two inches long. One lot was weighed as it came from the shed — wt. .810 gram — and put into the box. In one day the weight fell to .555 gram. Then being dried out to .495 gram, and again subjected to the action of the moisture, the sphagnum increased its weight to .530 gram in six days, and .540 gram after a further exposure. Dry weight, .420 gram.

The second lot was kept in the laboratory for two days, when it seemed utterly dry to the touch, but was still alive and green. Weight, .620 gram. Seven days later it weighed .630 gram. Dry weight, .500 gram.

In both cases there was some intake of water-vapor. In one the percentage of water rose to .20, in the other to .22. At best the moss remained in a state of relative desiccation.

It was hard to believe that the power of vapor-absorption detected could be of any practical importance in the economy of the plant, at least under the natural conditions prevailing in this part of the world. This conclusion is confirmed by the following observation. Both *Sphagnum* and *Leucobryum*, killed and dried at 100° C. and then replaced in the moistening chamber, rapidly took up vapor. In less than 24 hours the water contents of the dead moss thus derived, equalled that left when the living plants were allowed to dry out for one or two days in the same receptacle.

LICHENS. As compared with the other plants experimented upon, lichens show a considerable power of condensing atmospheric moisture. But though the absorption is enough to render lichens that come from outdoors in a harsh and brittle condition soft and flexible after a day or so, the highest proportion of water obtained by imbibition of vapor is very far below that which the lichens hold when well saturated by dew, rain, or soil-water.

The following figures will serve for illustration. *Usnea barbata* is the common much-branched lichen growing in tufts on the twigs and

trunks of trees. *Stricta pulmonaria* is a large thalloid, or flattened form clinging loosely on rough bark. "Wet weight" was taken after soaking in water and allowing to dry until no water appeared on the surface, "dry weight" after heating.

Species.	Wt. at start. Gms.	Time elapsed.	Humidity, etc.	Loss. Gms.	Gain. Gms.
<i>Usnea barbata.</i>	3.320	4 days.	.93-.95	.800	
	2.520	4 days.	In lab.	.485	
	2.035	3 days.	.93-.95		.245
	Wet weight, 4.650				
	Dry weight, 1.680				
<i>Sticta pulmonaria.</i>	2.320	1 day.	.93-.95.		.147
	"	25 days.	"		.250
	Wet weight, 5.240				
	Dry weight, 1.860				

One more table is added, designed to give a rough idea of the relative store of water retained after exposure in an atmosphere nearly saturated with water-vapor.

Species.	Percentage of water when well moistened.	Percentage after stay in box.	Time in days.
<i>Usnea barbata.</i>	.64	.26	+3
" "	.53	.20	+7
<i>Cladonia rangiferina.</i>		.20	+7
<i>C. cristatella.</i>		.25	±3 ¹
<i>C. pyxidata,</i>	.63	.22	-10
<i>C. furcata.</i>	.69	.36	-7
<i>Baeomyces roseus.</i>	.75	.20	-9
<i>Parmelia caperata.</i>	.54	.24	±3 ¹
<i>Sticta pulmonaria.</i>	.66	.27	+25

The positive and negative signs in the last column indicate whether the lichen was originally dry and had gained weight, or moist and had lost weight.

The figures are not presented as in any sense physical constants, but merely to show in a general way the relation of some lichens to a possible source of replenishment of their water supply in cases of the failure of atmospheric precipitation. After long exposure to very moist air the lichens possessed, it will be seen, but a low proportion of water. In outdoor humidities this would be still less considerable, and the quantities of water received in the form of vapor must be next to nothing in very dry weather. On the other hand in damp weather

¹ Two tests, three days losing, three days gaining; result about the same.

dew falls and is taken up in such measure by lichens that their tissues cannot be in condition to absorb vapor.

GENERAL CONCLUSIONS. Experiments have been made upon several classes of plants—some of them not mentioned above—which are asserted by one authority or another, of greater or less trustworthiness, to profit largely by their power of absorbing water in the gas form. A few figures, representative of a considerable number of tests, have been given in these notes. While these tests have seemed conclusive as regards the identical material employed, a much longer investigation would be required to enable one to make a general statement as to the direct utility of atmospheric moisture, as such, to actively vegetating plants. What I have seen tends to create in my own mind a doubt of any such utility.

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FURTHER ADDITIONS TO THE FLORA OF THE AMHERST REGION.

ROLAND M. HARPER.

ON examining recently a copy of Tuckerman and Frost's Catalogue of plants growing without cultivation within thirty miles of Amherst College (1875), I found that several plants which I had collected or observed within the limits of this catalogue during the past season were not mentioned in it.

A circle of thirty miles radius, with Amherst College as its center, would include, along its eastern edge, the greater part of Sturbridge, the whole of Brookfield, and several other towns in Worcester and Hampden Counties which I explored more or less in 1899.

The plants listed below are from these towns, and unless otherwise noted are new to the "Amherst region." Stations enclosed in parentheses have been already mentioned in my last list of additions to the flora of Worcester County (RHODORA, 1: 201-205), where further details concerning them may be found.

Potamogeton gemmiparus, Robbins. In Quaboag Lake, Brookfield, September 4 (altitude 615 feet). Also in a small pool in a meadow in Sturbridge, September 17 (altitude 560 feet). This species was collected in Amherst in September, 1874, by Prof. H. G. Jesup, but it